Mulching and Guar Gum

Substitutes for This Familiar "Binder" Tested

COURTESY OF HYDROSTRAW, LLC (D3048-1)

Technician Nathan Hoegger of HydroStraw, LLC, applies a hydromulch containing an experimental binder to a test plot at the corporation's Manteno, Illinois, facility.

You've probably driven past highway crews that are busily spraying a green coating on newly graded slopes. They may be working with a hydraulically applied mulch, or hydromulch—a temporary, porous coating that can, for example, help protect newly sown seeds.

A typical hydromulch contains water; a green dye, so that crews can easily see where they've been; a mulch, such as wood fibers; and a binder—a compound that helps keep the mulch intact.

One binder that's commonly used for hydromulch is guar gum, an off-white powder made by grinding beans of the guar plant. When water is added, the powder quickly forms a viscous gum.

Most of the guar gum used in the United States—for hydromulching and an impressive array of other applications—is imported. A spike in guar gum prices in 2012 led Agricultural Research Service plant physiologist Steve Vaughn and colleagues to take a new look at 10 plant-derived compounds as potentially less-expensive alternatives to guar gum.

The study is part of ongoing research at ARS's National Center for Agricultural Utilization Research in Peoria, Illinois, to find new, environmentally friendly, industrial and food uses of crop plants.

For the research, Vaughn's group made experimental hydromulches, composed of water, straw as the mulch, and the candidate binder added as a dry powder in the same amount that guar gum is used in hydromulching. Each experimental hydromulch was then exposed to a series of tests that were designed to simulate the effects of warm, dry days, and of rainfall, which could loosen and carry off some of the mulch.

The dry weight of each hydromulch at the end of the tests was used, in a simple equation, to estimate the relative strength of each binder. "Essentially, less mulch loss meant a higher end-dry-weight and a stronger binder," says Vaughn, who is coordinating outdoor experiments as a followup to the lab tests.

Half a dozen binders were stronger than guar gum. They included xanthan gum, made by the bacterium *Xanthomonas campestris*; the plant-cell-wall compound lignin, to which calcium was added so that lignin could act as an adhesive; and psyllium, whose seed coat contains mucilage, a natural glue.

Others in the top six: Gums extracted from seeds of two mustard family members, camelina and lesquerella; and a starch-based material made of cornstarch loosely bound to sodium palmitate, a fat (technically, a fatty acid) found in many everyday vegetable oils. Peoria researchers George Fanta, Fred Felker, and Jim Kenar developed the environmentally sound process for creating this compound, referred to as a "high-amylose starch-lipid inclusion complex."

Vaughn says that, to the best of his knowledge, the panel of 10 compounds selected for the lab tests is unique. Although starch has been used commercially as a hydromulch binder, starch-lipid complexes made with the eco-friendly process developed at Peoria apparently had not been—until this study—lab-tested for this specific use.

Details are in a 2012 article in *Industrial Crops and Products,* written by Vaughn, Fanta, Felker, and Kenar; Steve Cermak, Bob Behle, Mark Berhow, and Roque Evangelista, also with the Peoria center; and by Ed Lee of HydroStraw, LLC.—By **Marcia Wood,** ARS.

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